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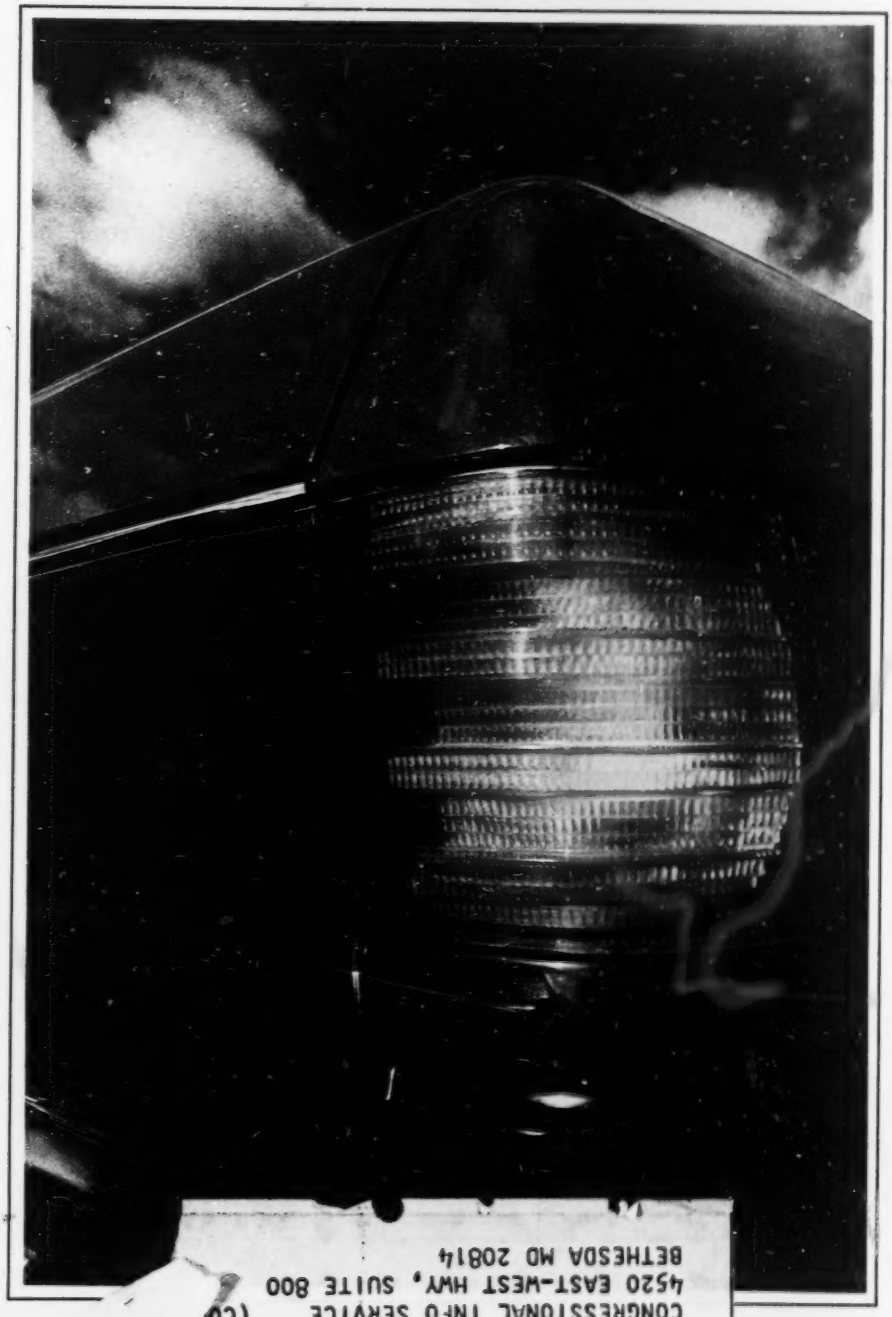

Production Survey: WHO BUILDS CARS BEST?

What Plant Where?:
Assembly And Stamping Plant Locator

Ford's Aerostar:
More Minivan Madness

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January, 1985/Volume 165, Number 1

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Who builds the most defect-free car as it comes off the assembly line? Hint: thanks to M-B for the 380 SL used on the cover.

NEXT MONTH

February brings *AI's* 1985 Man of the Year, Philip Caldwell, out-going chairman of Ford Motor Co.

QUOTABLE

"The workers are allowed to drink beer on the line because beer is an essential nutrient of the Bavarian workforce."—Audi tourguide in Ingolstadt paint shop, replying to quip about German workers drinking suds on the job.

"Deere's been one of the few in the business with the balance sheet to go with the business. Now there's somebody else with the balance sheet."—Ron Heiligenstein, chairman of the agricultural consulting firm Brock Associates, speaking about John Deere's newborn IH/Case competition and its big-buck parent, Tenneco.

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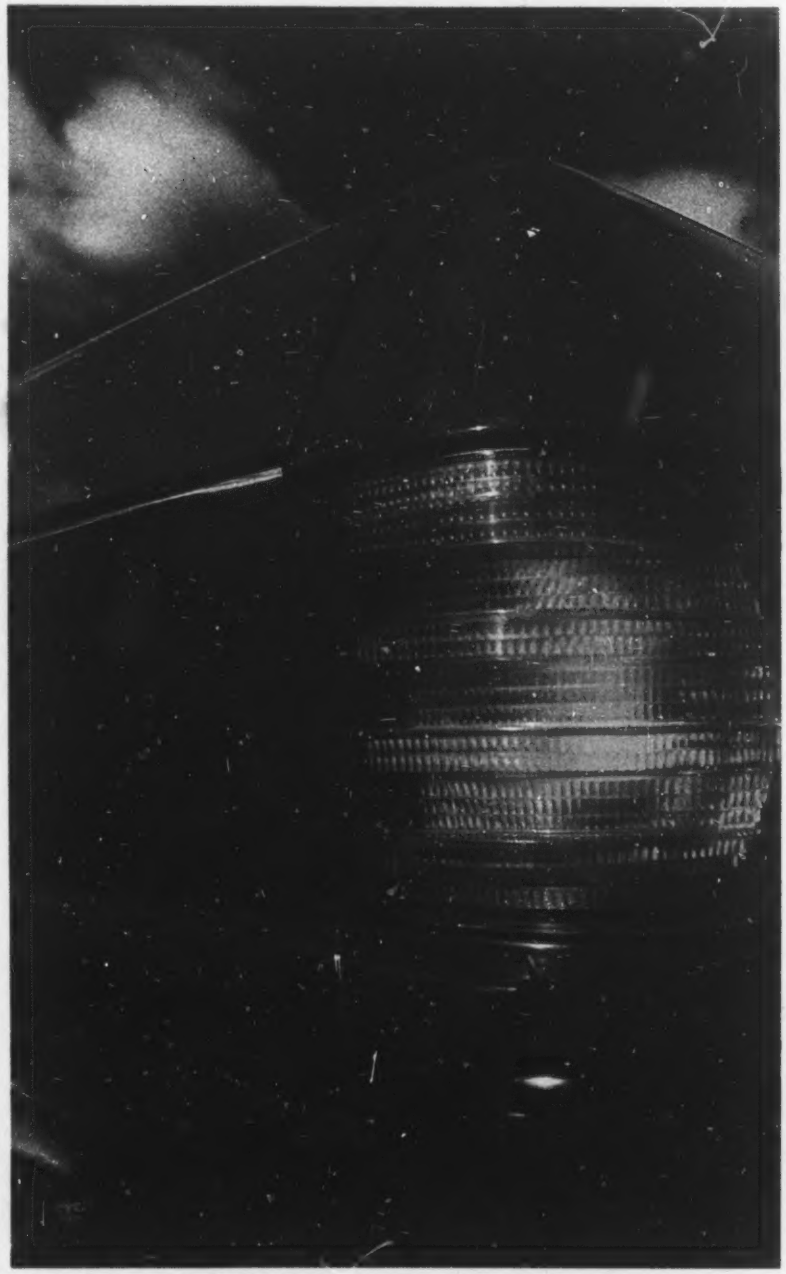
WHO BUILDS CARS BEST?

Going a step beyond your average automobile popularity contest, we ask the men who build the cars who among them builds the best.



Detail shot of a 1985 Mercedes-Benz 380 SL roadster.

by Lance A. Ealey

Who builds the most defect-free car as it comes off the assembly line? According to 1132 world-wide car manufacturing and production managers, engineers and technicians, the overwhelming answer is Mercedes-Benz. With 26.8% of the vote, Mercedes-Benz apparently inspires more than a little respect among those who should know: the men and women who build cars around the world.

Second place went to General Motors, with 18.2% of the vote, Ford grabbed third at 11%, and Toyota came in fourth and Honda fifth at 10.1% and 10% respectively.

Company Men

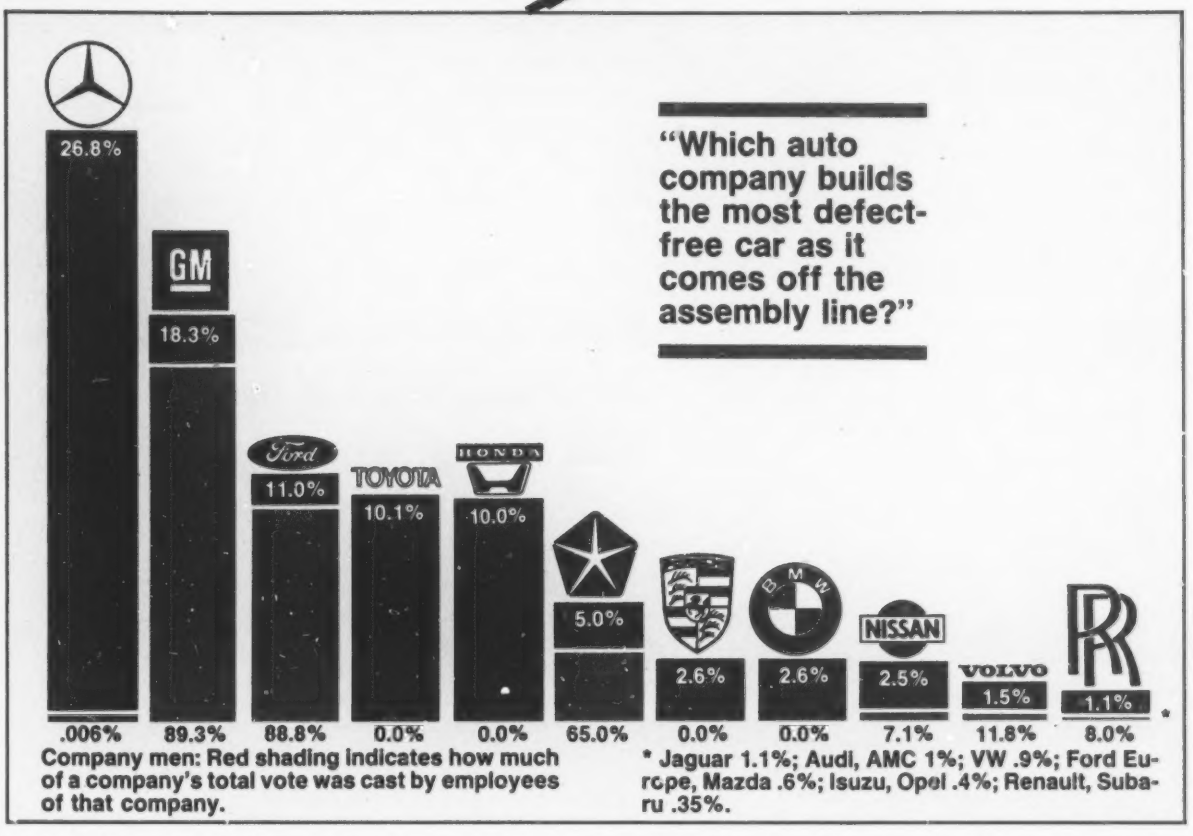
What makes Mercedes' victory all the more meaningful is that, of those who voted for M-B, only a handful work for the marque. Of those who voted for second place GM, over 89% are on the General's payroll, and at third place Ford, almost 89% of those who picked Ford USA work there.

Fourth place Toyota's and fifth place Honda's votes were all of the conquest variety, cast by respondents not associated with either company.

In fact, of all respondents, about 32% voted for the company they work for while the remaining 68% choose other companies. (One respondent who voted for Jaguar penned in beside the question on whether he worked for the company, "No, but I wish I did!")

The survey also shows a rather distinct pecking order of opinion as to who the top five builders of defect-free cars are. After fifth place Honda, the percentage of votes for the remaining companies drops off rather sharply, with Chrysler at 5%, followed by two prestigious German automakers, Porsche and BMW, both at 2.6%.

Our survey was sent out to 6532



manufacturing/production managers, supervisors, engineers and foremen world-wide, with the mailing list being generated from *AI's* world-wide circulation.

GM Best At Easy Build

General Motors easily outdistanced every other company as far as being the best at making a car easy to manufacture, with 22.9% of the vote.

In this classification Mercedes dropped to a low 2.1% of the vote: M-B may build near-perfect cars, but the consensus seems to be they don't have an easy time doing it.

Honda and Toyota both scored well in ease of manufacture. In fact, with a combined percentage of almost 50%, GM, Honda and Toyota dominated this category, with the remaining 50% split among 21 other companies.

On the question of fit and finish, Mercedes-Benz again came out on top, with 19.9% of the vote. GM came in second with 15.4%, while Ford was third with 11.5%. Both Honda and Toyota scored high in fit and finish. On the other hand, Nissan scored surprisingly low in both ease of manufacture and fit and finish, with tallies of 5.9% and 4.8% respectively.

Another surprising Japanese low scorer was Mazda, which earned only .6% of the votes on who builds the most defect-free car, and 1.7% and .97% respectively on ease of manufacture and fit and finish.

GM was high scorer in the reliability/durability category, with Mercedes a close second. In this category, Japanese automakers fared rather poorly, with Toyota getting 5%, Honda 2.9%, and the rest of the Japanese automakers scoring in fractional percentages.

Ford gained 13.8% of the reliability/durability vote, and one Ford industrial engineer was inspired to pen beside this question, "Ford, because there are more old Fords on the road than any others."

On the question of whether cars are harder to build today than they were 10 years ago, 58% said they were, while 42% said, no, they were easier to assemble. A GM reliability engineer added the note, "If you are referring to the engineering aspect, then the answer is yes, it's harder, but the actual build is easier."

GM earned nearly three times as many votes as its nearest rival on the question of which auto company best integrates design, engineering and manufacturing. One obviously partisan Buick engineer wrote "It appears that Buick City will be it!"

US Best

The United States won handily on the questions asking which country's engineers are best at problem-solving, design and production engineering. Wrote one 21-year veteran GM process-tooling engineer, who added the qualifier "current new models only" in ranking the US first: "we have taken the lead!"

The two countries following the US in all three categories were Japan and W. Germany, with the Japanese rank-

(Continued)

"Are today's cars easier or more difficult to build than cars built ten years ago..."

More Difficult	58%
Easier	42%

Never Send An Engineer To Do A Mailman's Job

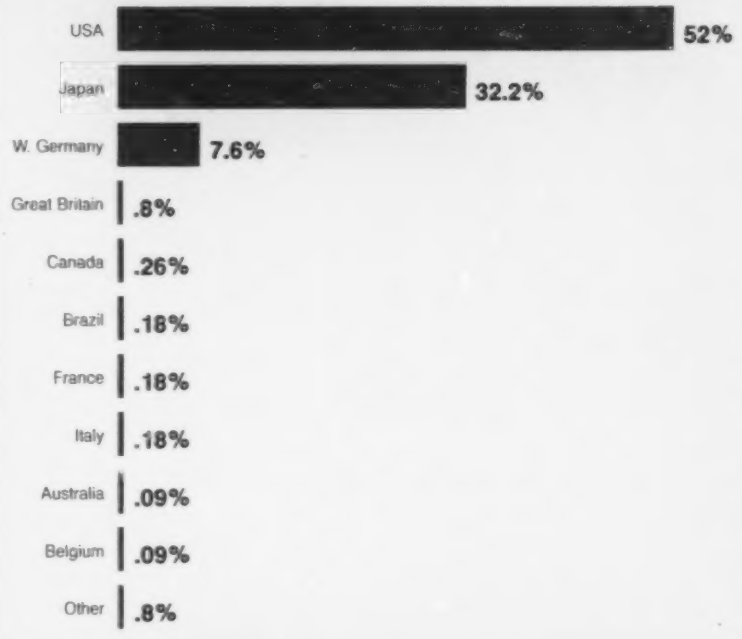
Our survey form stated simply, "Fold, Staple or Tape, and Mail." The condition of some of the questionnaire forms when we received them suggested that several engineers were possibly just a bit paranoid about the responses they had written to our questions.

Some forms were sealed so securely that they had to be torn in order to read the answers. Several of them contained three or four staples, while a few had been stapled about ten times all around the edges. Talk about over-engineering!

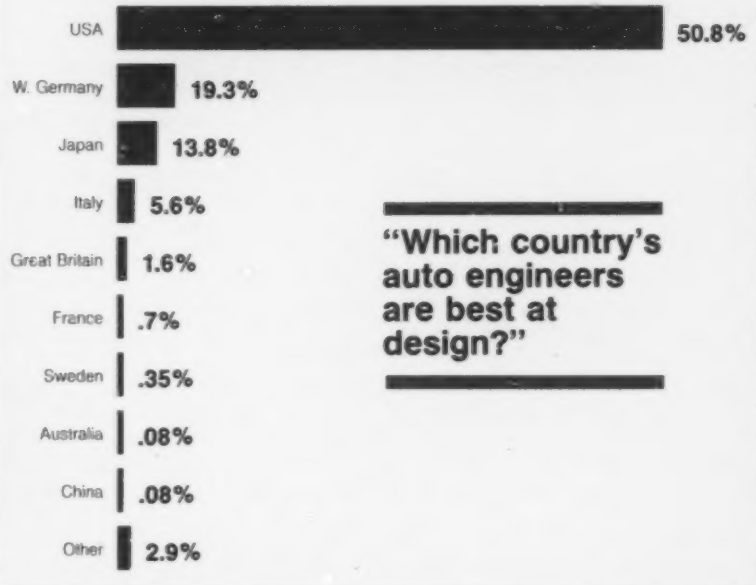
About five percent of the 1132 forms that were returned were glued closed and some of those had been stapled as well.

One form presented the biggest challenge: it was not only massively stapled but also taped around every edge with black electrical tape. Whoever you are out there, you'll be happy to know that I did get it opened without ripping it and your response is included in our results. Just don't go overboard next time, OK? —*Mary Ann Angeli, alias 'The Tabulator*

"Which country's auto engineers are best at problem-solving?"



"Which country's auto engineers are best at design?"



"...and will they become more difficult to build in the future?"

No!	**52%**
Yes!	**46%**

ing second in production engineering and problem-solving where Germany took second place in design.

In fact, the combined totals of the US, Japan and Germany in all three categories hovered in the 80-90 percent range, with the closest challenger being Italy, which received 5.6% of the vote in design. As one engineer broke design: "other than styling—Germany; styling—Italy."

Perhaps the most interesting part of the survey was that asking respondents to rate twelve systems or techniques as to their importance in improving the quality of cars being built.

Conformance to specification was considered by 37.7% as being of greatest importance, and we can assume that many in choosing this category were voting for the implied conformance to design intent—not just to getting tolerances to occur between the two widest specifications allowable. As one Ford engineer wrote, "consistency within spec is very important."

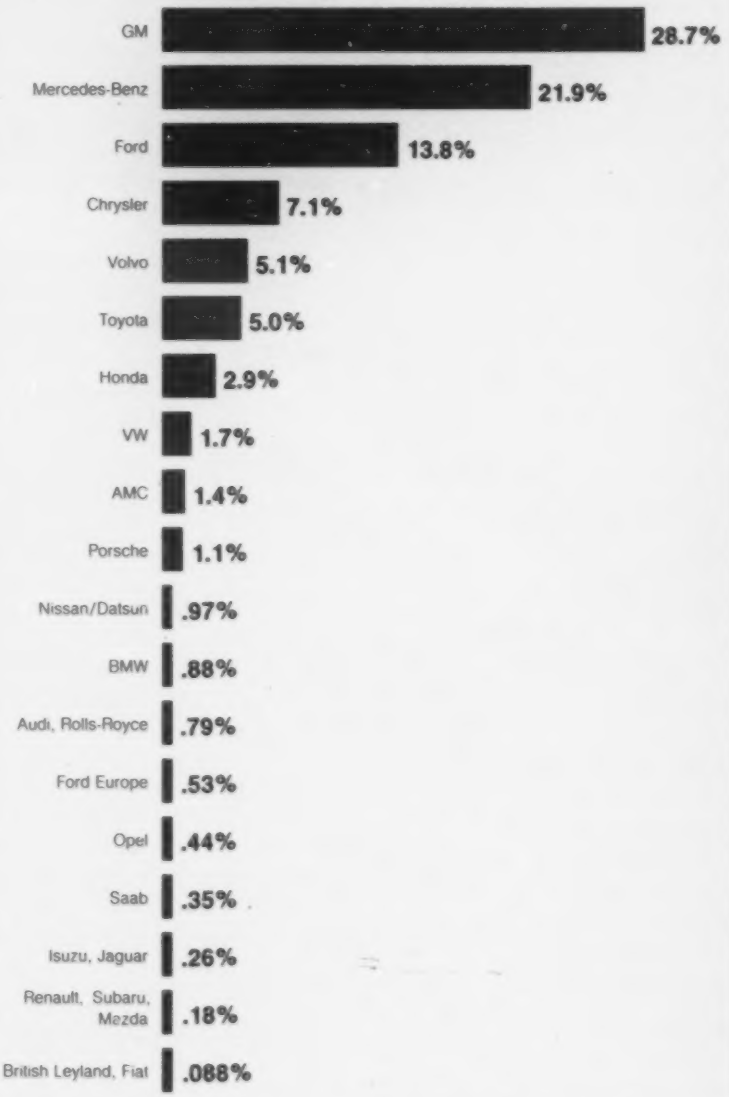
Second in the most important category was employee involvement, showing just how much awareness there is among the people who actually build cars of the need for a totally engaged labor force.

JIT A Snoozer

Just-in-time production achieved a surprisingly lackluster showing, landing on the bottom of the heap in the most important category, while achieving the highest score in the least important category. A few of the comments written beside just-in-time included, 'not necessary', 'doesn't

(Continued)

"Which auto company designs the best vehicles for reliability and durability?"



"If you personally use CAD/CAM in your day-to-day activities, how would you rate it as an effective tool?"

Effective	55%
Fairly Effective	43%
Not Effective	1.5%

work', and 'not effective'.

Most of the negative response generated by just-in-time production came from US engineers who apparently just don't go along with the build-as-needed-with-total-quality-control philosophy.

One telling comment from a US process engineer shows some of the frustration domestic manufacturers are having with attempts to implement just-in-time: "We cannot scrap [our] back order parts [supply method] and still run."

In looking at the rankings of most important versus least important categories, it becomes evident that the basics are on most manufacturing and production people's minds when it comes to quality: it's got to be in spec, and the best way to keep it in spec is through employee involvement with an emphasis in areas such as statistical quality control, preventative maintenance to keep good part productivity up, in-station inspection and stabilized schedules. Assembly automation was not high on most respondents' lists; neither was mass relief, which is often touted as vitally important to assuring consistent quality builds.

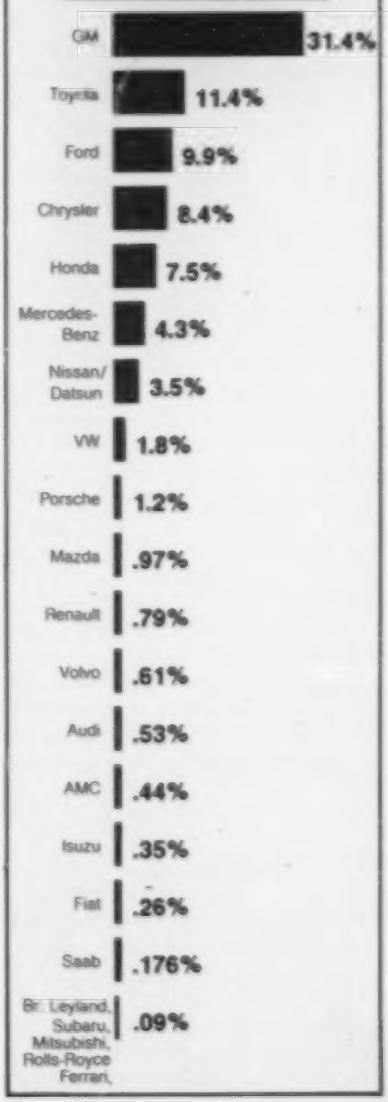
RANKINGS

	LEAST IMPORTANT								MOST IMPORTANT	
	1	2	3	4	5	6	7	8	9	10
Conformance to Specifications	2.2	1.8	2.1	2.8	5.4	5.1	8.7	17	13.7	37.7
Employee Input	3.2	3.2	2.8	3.0	7.4	6.8	8.6	15.7	10.2	36
Statistical Process Control	3.2	4.7	3.5	4.9	9.4	6.6	10.9	19.5	11.1	22.4
Preventive Maintenance	3.4	3.9	4.5	5.5	9.3	9.0	9.4	15.8	11.6	19.8
In-Station Inspection	4.0	3.7	5.7	5.3	10.9	9.0	10.6	15.4	11.9	16.5
Stabilized Schedules	2.3	3.4	4.2	5.8	11.7	8.2	12.7	17.9	11.8	14.6
Assembly Line Automation	3.0	3.6	3.6	6.0	14.0	10.6	11.0	19.3	9.7	13.8
Final Inspection	10.3	7.1	8.7	6.7	14.5	6.9	9.5	9.3	5.1	13.0
Manufacturing Resource Planning	2.8	4.2	6.4	6.5	14.4	11.5	12.3	15.9	7.6	11.4
Mass Relief	11.8	7.9	7.1	5.6	12.5	6.7	10.4	9.3	4.6	9.5
Reduced Setup Times	7.9	8.2	8.3	8.2	15.8	9.2	10.9	9.0	4.5	5.4
Just-in-time production	16.8	9.7	7.8	7.4	14.7	7.8	6.8	8.0	3.4	4.7

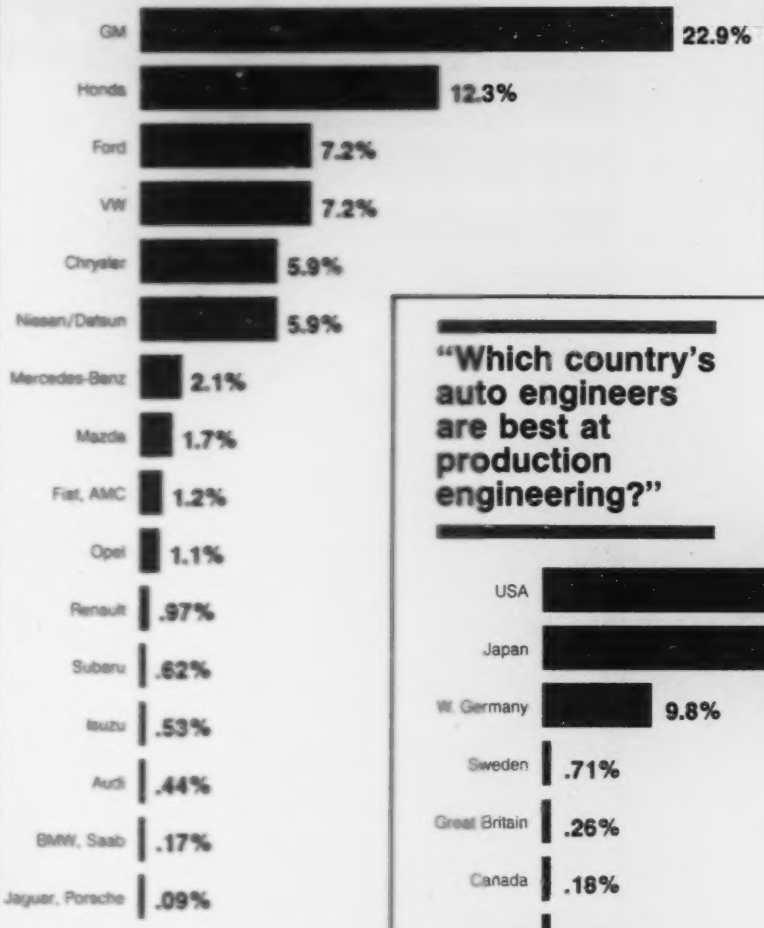
All figures are percentages

"Rate each of the following on a scale of 1 to 10 (with 1 being the lowest and 10 the highest) as to their *importance in improving quality in the cars you build.*"

"Which auto company best integrates Design, Engineering and Manufacturing?"



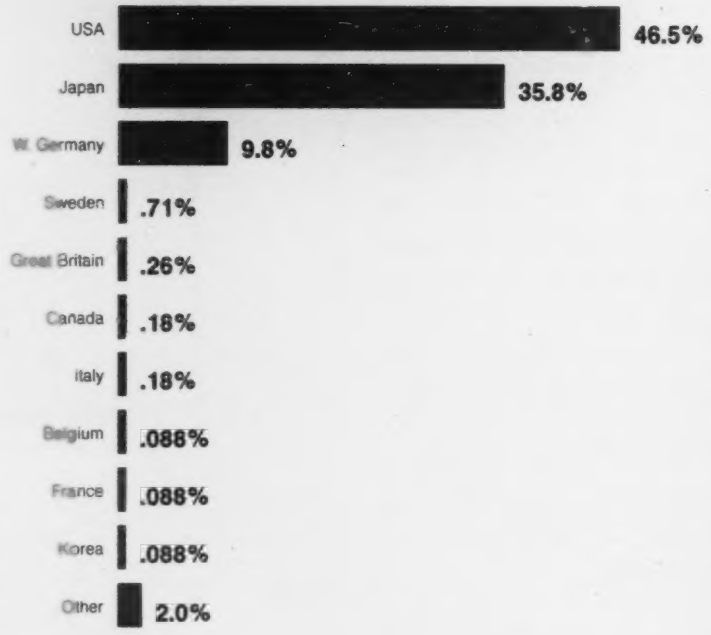
"Which auto company designs the best vehicles for ease of manufacture?"



"Should part of a plant manager's yearly bonus be based on quality levels achieved at the plant?"

Yes!	85.8%
No!	11.2%

"Which country's auto engineers are best at production engineering?"



Other Factors

For this question under the category 'other factors' came 19 votes for design, 18 for management commitment to quality, nine votes for design with assembly in mind, and five for design quality. One vaguely military-sounding vote was cast for "part deproliferation," another for pride,

(Continued)

one for politics and another for "enough people on the job." Another, apparently frustrated, engineer wrote "get rid of plastic parts that break all the time," while three engineers voted for experimental design, and one senior manufacturing engineer from Ford wrote, "engineers must regain control from accountants."

Around 30% of the respondents personally use CAD/CAM in their day-to-day activities, and of those, 55% considered it an effective tool, 43% said it was fairly effective while under 2% said it was not effective. Several respondents from outside of the US were not familiar with the term CAD/CAM.

On the thorny question of whether a plant manager's yearly bonus should be based on quality levels achieved at the plant, a resounding 85.8% said yes, it should.

Among the qualifiers to this mandate were: "only if quality audit is performed by out-of-plant personnel," and "if and when human judgement can be taken out of the current audit systems."

On the other hand, among the naysayers was a quality control technician who said: "He has the responsibility of the plant but if the workers wanted to they could really hurt him." Among those who disagreed entirely with the plant manager getting a bonus at all came, "Why should he get a bonus when the people that make it happen can't?" And from a general manufacturing superintendent, "I disagree with the bonus system, it's too short term-oriented."

Our last question asked for an honest evaluation of the respondent's own plant: how high do you rate the quality of the cars built in your plant? Almost 16% gave their plant a very high quality level, while the majority, 48% rated their quality high, 17.7% said average and only 2.7% rated their plants low or very low in terms of quality. ■

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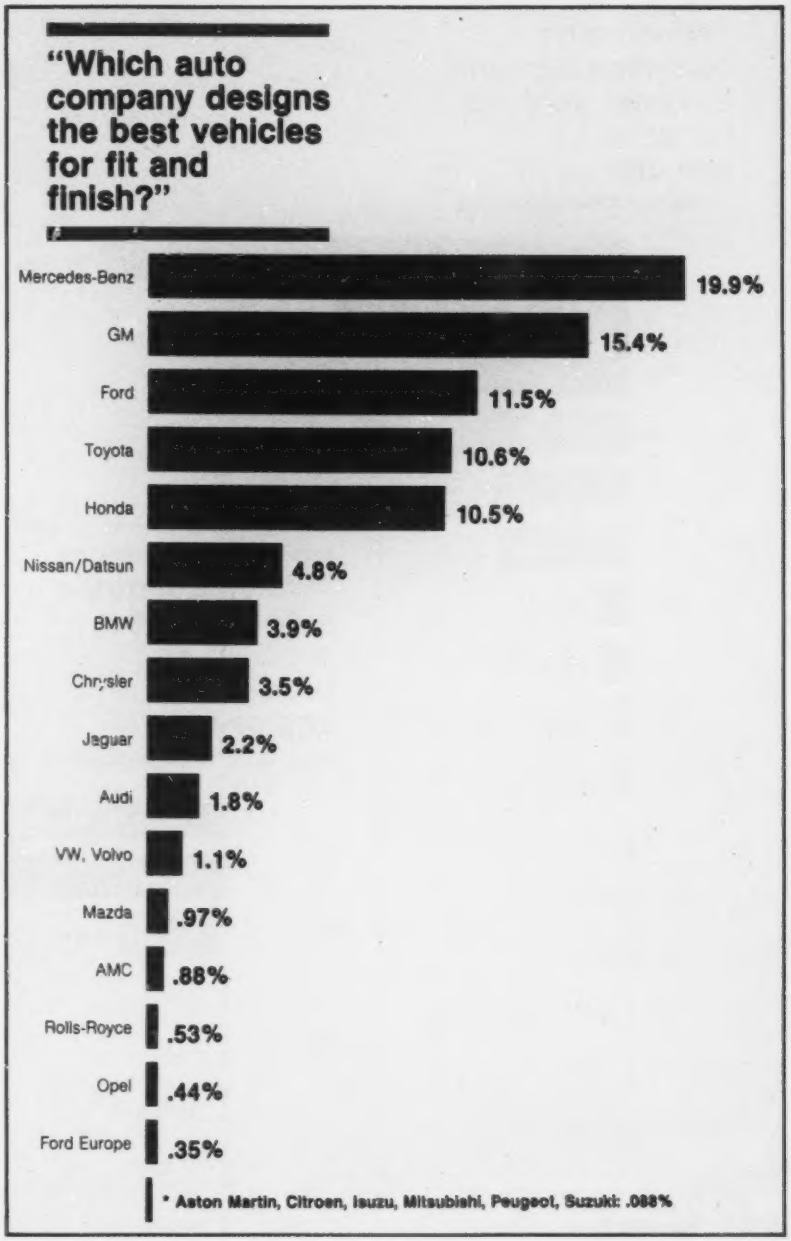


All chart percentages except those concerning CAD/CAM effectiveness are based on a total of 1132 respondents. The CAD/CAM effectiveness chart percentages are based on the number of respondents who indicated that they use CAD/CAM on a day-to-day basis. Many of the charts will not add up to 100% because some respondents did not answer all of the questions.
The US/international split of respondents was 88%/12%.

BIG GROWTH FORECAST FOR ZINC-COATED SHEET

The quest for tougher corrosion-fighting sheet-steel is causing US automakers to look to Japan's steel industry for a capacity-free source of supply. Will Zincrometal use diminish?

by Peter J. Mullins

The New United Motors Mfg Inc. (Nummi) plant in California (where General Motors and Toyota have a joint project to produce compact cars) will use monthly some 2000 tons (*1800 t*) of high tensile and corrosion-resistant steel sheet imported from Japan. Nippon Steel Corp. will supply half and the rest of the order is to be split between Sumitomo Metal Industries, Nippon Kokan Kaisha and Kobe Steel.

Naturally the Japanese steelmakers concerned are delighted at what they recognize is a major change in GM's normal 'buy American' policy. More important, they see it as a foot in the door to enable them to sell more sheet to other divisions of General Motors in the near future.

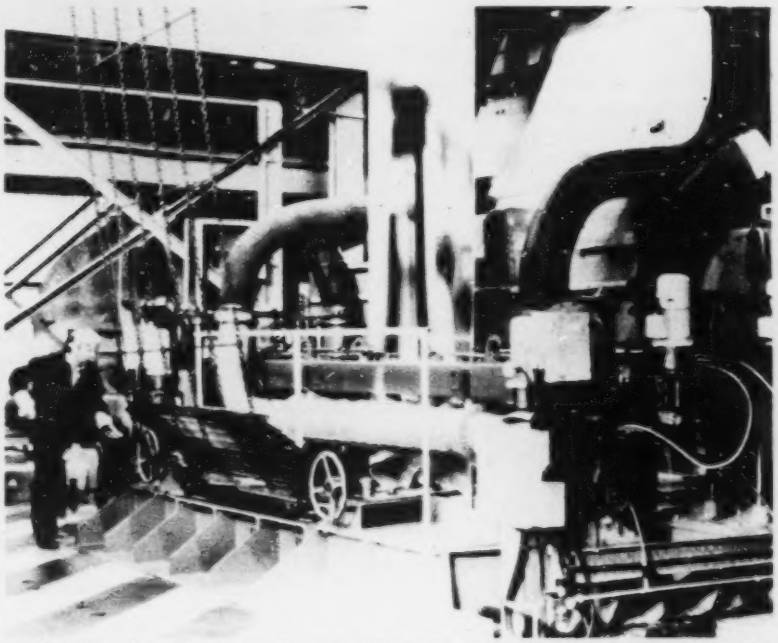
Why the shift in GM's policy?

Question Of Capacity

Basically, it's a question of capacity. The American steel industry has been caught by the auto companies' drive for long-lasting corrosion protection. US capacity for hot-dipped galvanized sheet is around 6½ to 7 million ton/yr and 1984 demand is running at about this figure (*5.9-6.3 million t/yr*).

There are, however, a number of complications. The auto industry is trending towards sheet that is not only coated on the inside—to protect the closed box sections where most of the worst corrosion has been proven to start—but on both sides. This will enable carmakers to meet the much tighter regulations coming in 1986 which demand 5 years cosmetic and 10 years structural protection.

Also, the auto industry wants sheet that is easily formed—similar to the cold-reduced sheet presently used but having zinc coating on one side only.



End of hot-dip galvanizing line at British Steel Corporation's Shotton Works.

Electro-galvanized steel is preferred in this respect because of carmakers' requirements. But the US steel industry is even shorter of electrolytic galvanizing capacity than it is of hot dip.

Electro-Zinc For The Future

Most steel industry experts agree that the electro-zinc process is the versatile way for the future. A number of American steel companies have plans under way to install electrolytic capacity. These include Bethlehem, Inland, US Steel and Wheeling-Pittsburgh, the latter being a joint project with Nisshin Steel of Japan.

Japanese steelmakers have established a big lead in electrolytic capacity and have some five or six electrolytic lines now in operation. Ironically, the whole Japanese lead was built up on the basis of the need in the North American market for corrosion protection for their exported cars.

There was not the same need in the Japanese domestic market and many Japanese cars operating at home use conventional primers and paints only.

According to Austin Matthews, manager of product marketing for BSC's Strip Products Group, up to around 1989 there will be a steady shift from Zincrometal and cold-rolled sheet to zinc-coated, mainly to improve perforation resistance.

The zinc-coated sheet will mostly be single-sided in the first instance and a mixture of electrolytic and hot dip with the former being predominant. (Zincrometal, incidentally, is a zinc-bearing paint hitherto used extensively by US carmakers.)

(Continued)

Evolution Toward Two-Sided Coat

There is likely to be an evolution from one- to two-sided zinc coatings to maintain the perforation resistance and gradually improve the cosmetic protection.

Towards 1986, electro-zinc alloy coatings could be coming in strongly in Europe. These include iron and nickel-zinc alloys and multi-layer coatings with chromium and chrome-oxide on top.

These will offer improved qualities such as corrosion resistance, good paintability and enhanced welding properties because of the use of thin coatings.

During the same period, hot-dip zinc coating will be used because of the improved steel and zinc surface qualities. The choice between hot dip and electrolytic will depend on individual carmakers' progress.

Nevertheless, quality car makers like Porsche have switched to all-zinc-coated bodies and French carmakers are not only quite advanced but already using single-side electro-zinc and hot dip galvanizing for volume car models. In fact, it is a French company Ziegler, (part of the Sacilor group) that is the first in Europe to get into production with Galfan, a new development for which great claims are made.

Galfan Claims Made

Galfan is a zinc alloy coating which contains 5% aluminum and rare earths (700 ppm).

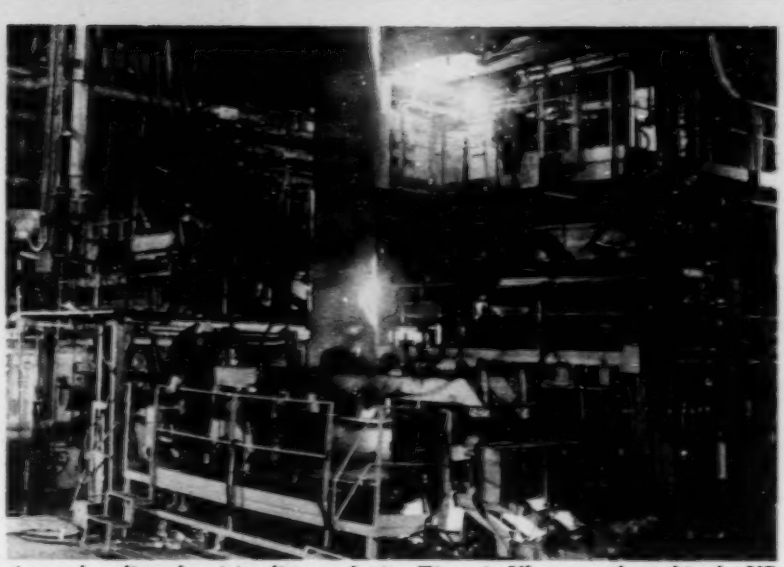
Developed by the Centre de Recherche Metallurgiques in Liege under the direction of the International Lead Research Organization (ILRO), the process has been licensed to several European companies and Inland in the US. So far, Ziegler and Hoesch in Germany, are the only companies to market the product in Europe.

Advantages claimed for Galfan include good adhesion and high corrosion resistance—at least double that of conventional galvanized steel. It is claimed to be higher suited to complex stamped parts because of its good adhesion under severe deformation.

Experts are forecasting a period of sharp growth in the market for electrolytic zinc-coated sheet from 1984 to 1987.

Thereafter, to about 1990, electrolytic and hot dip galvanized sheet should grow steadily, partly at the expense of Zincrometal and partly with market expansion.

Currently, around 470,000 ton/yr of zinc-coated products are used in the European motor industry. By 1990, this figure is likely to be up to 750,000 ton/year (*426,000 vs. 680,000 t/yr*).■



Armco hot-dip galvanizing line producing Zincgrip Ultrasmooth steel in the US. US capacity for hot-dipped galvanized sheet is around 6½ to 7 million tons per year: about the same level 1984 US demand is running..

AUTOMOTIVE GALVANIZED STEEL UTILIZATION PROJECTIONS

(Million Tons)

Year	'83	'84	'85	'86	'87	'88	'89
Domestic Galvanized Steel Shipments							
Hot Dipped	1.27	1.50	1.46	1.22	1.21	1.35	1.35
Electro	.45	.50	.60	.78	1.20	1.40	1.50
Total	1.72	2.10	2.06	2.00	2.41	2.75	2.85
	Pounds of Domestic Coated Steel/Vehicle (Blank Weight)						
Hot Dipped	240	260	265	255	235	240	240
Electro	85	100	110	165	235	250	260
Zincrometal	180	180	170	140	100	80	70
Total: Coated Steel Use	505	540	545	560	570	570	570

(Courtesy: BSC)

Projections showing US domestic use of galvanized steel. Note that whereas the demand for hot-dip galvanized steel plateaus out between 1.2 and 1.4 million ton, the use of electrolytic galvanized steel is expected to triple from about 0.45 to 1.5 million ton by 1989. Total use of zinc-coated steel per car is expected to rise by nearly 13%.

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